

## ABSTRACT

An exhaust manifold cooling jacket has internal passages for the circulation of liquid coolant and encloses an exhaust manifold such that a gap is created between the exhaust manifold and cooling jacket. Flowing coolant through the jacket regulates outer jacket  
5 temperature while enabling high intra-manifold exhaust gas temperatures for thorough intra-manifold combustion and improved emissions. A liquid-cooled exhaust system includes a turbocharger disposed between manifold and elbow, with liquid coolant flowing from manifold to elbow through the turbocharger. Another liquid-cooled exhaust manifold contains an internal exhaust combustion catalyst wrapped in an insulating blanket. In some  
10 marine applications, seawater or fresh water coolant is discharged into the exhaust gas stream at an attached exhaust elbow.

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